The impact of program type on bilingual language growth

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Background

The language growth of English Language Learners (ELLs; Rojas & Iglesias, under review)

Modeled the language growth of 1,723 (Spanish-English) ELLs
- Fall of kindergarten to spring of second grade
- 12,248 Narrative retell language samples:
  - 6,516 Spanish; 5,732 English
- Covariates: Gender; summer vacation
- Outcome measures: Mean length of utterance in words (MLUw); Number of different words (NDW)

Aims
- Differences with respect to prototypical language trajectories
- Intra- and inter-individual differences
- Systematic relationship between initial status and growth

Purpose & Method

Does ELLs' language growth differ by program type?

Structured/sheltered English immersion (SEI) programs:
- SEI goal: fluency in English with only ELLs in classroom

Transitional bilingual education (TBE) programs
- TBE goal: skills + proficiency in native language and English

Participants

Subset of ELL children from Rojas and Iglesias (under review)
- Schools that offered SEI programs exclusively
  - 419 ELLs: 198 girls; 221 boys
  - 2,924 narrative retell language samples:
    - 1,497 English; 1,427 Spanish
- Schools that offered TBE programs exclusively
  - 694 ELLs: 345 girls; 349 boys
  - 4,354 narrative retell language samples
    - 1,936 English; 2,418 Spanish

Method (continued)

Growth curve modeling (GCM)
- Maximum likelihood estimation method to handle missing data and estimate fixed effects and variance components
- Academic semester served as time metric
- Centering relative to fall of kindergarten as initial status
- GCM testing to determine final GCMs for each outcome measure:
  - Unconditional means model → Unconditional growth models (linear, quadratic, and cubic; fixed and randomly varying slope configurations) → Conditional growth models (gender and discontinuous time; gender *x* slope interactions)
  - Goodness of fit indices (-2LL for nested models; BIC for non-nested models) and Pseudo-R^2 statistics with χ^2 testing estimated and tested across models
  - Prototypical growth curve trajectories generated from final GCM parameter estimates

Summary

ELLs' language growth in Spanish and English: **TBE Programs**

	Spanish		English	
	MLUw	NDW	MLUw	NDW
Linearity	Curvilinear	Curvilinear	Linear	Linear
Direction	Non-monotonic	Non-monotonic	Non-monotonic	Non-monotonic
Continuity	Continuous	Continuous	Discontinuous	Discontinuous
Gender	Girls outpace boys *(K-fall)*	Girls outpace boys *(K-fall)*	*Girls ~ boys*	Boys outpace girls (fall) Girls outpace boys (spring)
Summer vacation	n/a	n/a	Slower (boys) Negative (girls)	Faster (boys) Slower (girls)
Initial status-growth covariance	No systematic relationship	No systematic relationship	Negative (↓ initial status = ↑ growth)	Negative (↓ initial status = ↑ growth)

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Summer vacation	n/a	n/a	Negative growth	*Near parallel growth*
Initial status-growth covariance	*No systematic relationship*	No systematic relationship	Negative ↓ initial status = ↑ growth)	*No systematic relationship*

Final growth curve models

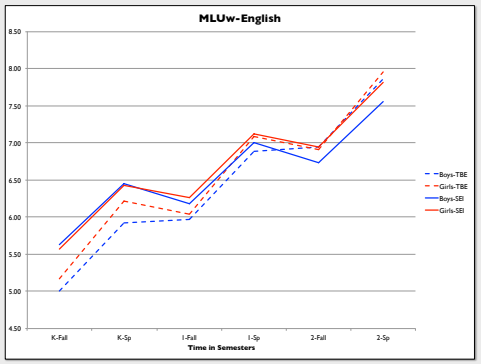
Table 1. Comparisons of continuous and discontinuous growth curve model parameter estimates for Mean Length of Utterance in words in Spanish and English (MLUw-S/E), and for Number of Different Words in Spanish and English (NDW-S/E)

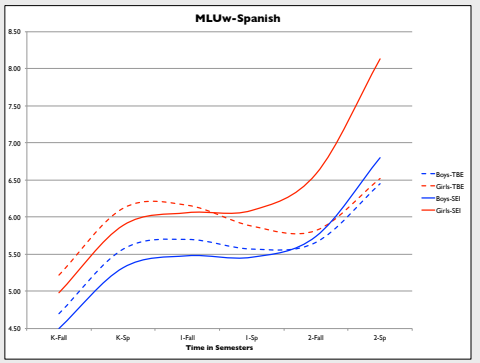
		TBE-MLUw-S CG-Ch+G	SEI-MLUw-S CG-Ch+G	TBE-MLUw-E CG-Dc+G	SEI-MLUw-E CG-Dc+G	TBE-NDW-S CG-Ch+G	SEI-NDW-S CG-Ch+G	TBE-NDW-E CG-Dc+G	SEI-NDW-E CG-Dc+G
Fixed effects									
Intercept	γ_{00}	4.66[c]	4.49[c]	4.99[c]	5.63[c]	53.15[c]	47.04[c]	37.21[c]	56.27[c]
Linear Slope	γ_{10}	1.44[c]	1.31[c]	0.97[c]	0.55[c]	31.19[c]	21.29[c]	22.88[c]	16.42[c]
Quadratic Slope	γ_{20}	-0.61[c]	-0.57[c]	0.92[c] Summer	0.82[c] Summer	-12.18[c]	-7.63[c]	9.68[c] Summer	8.21[c] Summer
Cubic Slope	γ_{30}	0.08[c]	0.08[c]			1.52[c]	0.93[c]		
Gender (G)	γ_{01}	0.26[a]	0.24[a]	0.17	-0.06	3.89[a]	5.85[a]	3.24	-0.4
G x Linear Slope	γ_{11}	0.11	0.17	-0.10	0.14[a]	4.44	7.17[c]	-2.4[a]	1.13
G x Quadratic Slope	γ_{21}	-0.09	-0.10	0.12 G x Summer	0.04 G x Summer	-2.36	-4.37[a]	3.85[b] G x Summer	0.79 G x Summer
G x Cubic Slope	γ_{31}	0.01	0.02			0.31	0.59[b]		
Variance components									
L1: Within-person variance	σ_e^2	0.55[c]	0.53[c]	0.69[c]	0.65[c]	214.44[c]	216.35[c]	206.69[c]	245.67[c]
L2: B/w-person intercept	σ_0^2	0.32[c]	0.28[c]	1.48[c]	0.67[c]	141.85[c]	180.74[c]	505.54[c]	314.73[c]
L2: B/w-person linear slope	σ_1^2			0.18[c]	0.05		1.18	14.46	
L2: B/w-person quadratic slope	σ_2^2	0.01[a]							6.12 Summer
L2: B/w-person cubic slope	σ_3^2	0.0004[c]	0.00001[a]						
Covariance (σ_0^2, σ_1^2)	σ_{01}			-0.46[b]	-0.15[a]		-1.07	-39.16[c]	
Covariance (σ_0^2, σ_2^2)	σ_{02}	-0.027[a]							-15.38 Summer
Covariance (σ_0^2, σ_3^2)	σ_{03}	0.005	0.0002						
Covariance (σ_1^2, σ_3^2)	σ_{23}	0.002[c]							
Proportional variance reduction									
L1: Within-person variance	R_e^2	51%	44%	54%	43%	41%	31%	60%	46%
L2: B/w-person intercept	R_0^2	6%	5%	2%	<1%	4%	9%	2%	<1%
L2: B/w-person linear slope	R_1^2			5%	7%		10%	<1%	
L2: B/w-person quadratic slope	R_2^2	<1%							<1% Summer
L2: B/w-person cubic slope	R_3^2	<1%	<1%						
Goodness-of-fit									
-2LL		6276.1[b]	3607.0[c]	5428.4[c]	3648.5[c]	20619.9[c]	12253.5[c]	16241.1[b]	11713.2
BIC		6393.0	3694.1	5503.5	3720.4	20697.9	12340.6	16316.3	11785.1

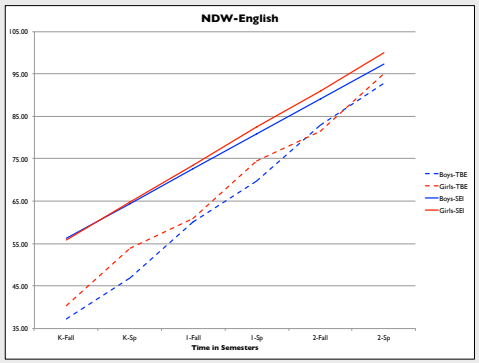
[a] $p < .10$. [b] $p < .05$. [c] $p < .01$. [d] $p < .001$.

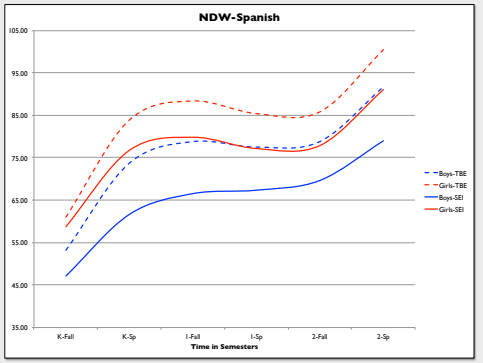
Note. TBE: Transitional Bilingual Education; SEI: Structured/Sheltered English Immersion; CG-Ch+G: Conditional cubic growth model with gender; CG-Dc+G: Conditional discontinuous growth model with gender; L1: Level-1 submodel; L2: Level-2 submodel; -2LL: -2 log-likelihood deviance statistic; BIC: Schwarz's Bayesian information criterion.

Growth curve trajectories: TBE and SEI programs









Conclusions & Next steps

ELLs in TBE and SEI programs differed

At face value, some growth patterns were expected:
- TBE-ELLs had higher MLUw and NDW at initial status in Spanish
- SEI-ELLs had higher MLUw and NDW at initial status in English
- TBE-ELLs extended initial status advantage in NDW-Spanish

However, other growth patterns were unexpected:
- TBE-ELLs began closing the "English gap" with SEI-ELLs over time
- TBE-ELLs exhibited staggering growth of NDW in English
- SEI-ELLs demonstrated crossover of MLUw-Spanish with TBE-ELLs
  - SEI-girls demonstrated crossover with TBE-girls during first grade
  - SEI-boys demonstrated crossover with TBE-boys between fall of first grade and spring of second grade

Modeling growth beyond "program type"
- Necessary to consider the fidelity of language instruction by teacher
  - Use actual language of instruction as a covariate of language growth

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